

Ultra-Efficient Engine Technology Project Integrated Into NASA's Vehicle Systems Program



The UEET Project will develop and deliver revolutionary gas turbine propulsion technologies for increased performance and efficiency at the component or subsystem level, relying on strategic, cost-sharing partnerships and opportunities with the aerospace industry and other Government agencies for technology demonstration, maturation, and application.

The Ultra-Efficient Engine Technology (UEET) Project is formulated according to the Office of Aerospace Technology's objectives as outlined in the NASA Strategic Plan. It is directly related to the "protect the environment" objective and will make progress toward the "increase mobility" and "support national security" objectives as well. UEET technologies will impact future civil and military aircraft and will benefit the development of future space transportation propulsion systems. UEET Project success will, therefore, depend on developing revolutionary, but affordable, technology solutions that are inherently safe and reliable and thus can be incorporated in future propulsion system designs.

In fiscal year 2003, UEET became part of NASA's Vehicle Systems Program and continues to evolve its programmatic role. The Vehicle Systems Program aims to develop breakthrough technologies and methodologies, push the boundaries of flight through research on advanced vehicle concepts, respond quickly to industry and the Department of Defense on critical safety and other issues, and provide facilities and expert consultation for industry and other Government agencies during product development.

UEET's two primary goals make it viable within this framework: (1) develop propulsion technologies that will increase system efficiency and, therefore, reduce fuel burn by up to 15 percent (with equivalent reductions in carbon dioxide emissions) and (2) develop combustor technologies (configuration and materials) that will reduce landing and takeoff emissions of nitrogen oxides by 70 percent relative to 1996 International Civil Aviation Organization (ICAO) standards.

Long-range scenarios developed under ICAO auspices foresee continuing worldwide growth for commercial aviation through the middle of the next century. Given the current constraints on growth due to noise and emissions, propulsion will play a lead role in finding viable solutions. Propulsion also will play a critical role in enabling advanced aircraft designs and concepts required to achieve dramatic improvements in efficiencies of operations. Today's engine designs are limited by both the overall cycle pressure ratio and turbine inlet temperature levels that can be achieved. Increases in both parameters will be required to improve performance and efficiency, as well as reduce global climate impact.

UEET addresses potential ozone depletion concerns by demonstrating enabling aircraft combustor technologies that have little or no discernable impact on the ozone layer during cruise operation (up to a 90-percent reduction). This project will enable the United States to be competitive in developing propulsion systems with very low emissions. In addition, UEET will address the potential of climate impact on long-term aviation growth by providing critical gas turbine propulsion technologies that will increase efficiency dramatically to enable carbon dioxide reductions, on the basis of an overall fuel savings goal of about 15 percent for large subsonic transport and as much as 8 percent for supersonic and/or small aircraft. Fuel savings represent significant cost benefits to the traveling public.

UEET has continued to place top priority on exploring and developing meaningful partnerships with Department of Defense programs such as the Integrated High

Performance Turbine Engine Technology (IHPTET) and Versatile Affordable Advanced Turbine Engine (VAATE) programs. Strategic partnerships have also been formed with the Department of Energy, the Environmental Protection Agency, and the Federal Aviation Administration on technology development and technology requirements definition. These partnerships will enable each program to leverage relevant technologies being developed in other programs as well as provide opportunities for joint technology development.

The overall UEET project includes research efforts at the NASA Glenn Research Center, the NASA Langley Research Center, and the NASA Ames Research Center, as well as at the following partner organizations: Air Force Research Laboratory, Allison/Rolls-Royce, Boeing Commercial Airplane Company, GE Aircraft Engines, Georgia Institute of Technology, Gulfstream, Honeywell, Lockheed Martin Corporation, Pratt & Whitney, and Williams International.

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